DOE–EM/GJTAC3040

Office of Environmental Management – Grand Junction

MOAB UTAH
UMTRA Project

Environmental Air Monitoring Data Quarterly Report for the Moab and Crescent Junction, Utah, Sites Third Quarter 2020 (July through September 2020)

Revision 0

December 2020

U.S. Department of Energy

Office of Environmental Management

Prepared by the Technical Assistance Contractor under contract number DE-AC30-07CC60012 for the U.S. Department of Energy Office of Environmental Management, Grand Junction, Colorado.

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Review and Approval

12/21/2020

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Revision History

Revision	Date	Description
0	December	Initial issue.

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1.0 Introduction

The purpose of this Report is to present the results of environmental air monitoring at the U.S. Department of Energy (DOE) Moab Uranium Mill Tailings Remedial Action (UMTRA) Project sites during the third quarter of 2020. The Project sites consist of the former uranium ore-processing mill located three miles north of Moab, Utah**,** and the disposal site located near Crescent Junction, Utah.

2.0 Regulatory Requirements

This Report demonstrates compliance with DOE Order (O) 458.1, Admin Chg 1, "Radiation Protection of the Public and the Environment," which states DOE radiological activities must be conducted in a manner that does not cause total effective dose to the public to exceed 100 millirems (mrem) in a year, or an equivalent dose to the lens of the eye exceeding 1,500 mrem in a year, or an equivalent dose to the skin or extremities of 5,000 mrem in a year. This limit excludes doses from background radiation, radon gas and its decay products in air, occupational doses, and medical exposures.

For the Project, the total effective dose is the sum of the direct gamma radiation (less background) and radioactive particulate material (radioparticulate) exposure. DOE O 458.1 also specifies releases of radioactive material to the atmosphere from DOE activities shall not exceed an annual average concentration of 3 picocuries per liter (pCi/L) of radon or its decay products, excluding background, at the site boundary.

Compliance with DOE O 458.1 is demonstrated by calculating the total effective dose to the maximally exposed individual (MEI) or the representative person or group from the public likely to receive the highest radiation dose based on exposure pathways and parameters. The Project has established an MEI for the Moab and Crescent Junction Project sites.

3.0 Results for July through September 2020

Monitoring data are reported quarterly for radon, direct gamma radiation, and select radioparticulates. Off-site monitoring locations for the Moab site are shown on Figure 1, and on-site and MEI locations are shown on Figure 2. Monitoring locations for the Crescent Junction site are shown on Figure 3. Based on results from the *Moab UMTRA Project Fourth Quarter 2019 Environmental Air Monitoring Report,* and Rapidos and Radtrack^2 detector comparison from 2019, the air program has moved forward with using Rapidos radon monitors.

3.1 Moab Site

There are a total of 27 air monitoring stations equipped with radon and gamma detectors associated with the Moab site. 15 of these stations are located within the site boundary, while the additional 12 are located at relevant locations off-site. Of these 27 stations, three on-site and six off-site stations are also equipped with air sampling pumps to measure air radioparticulates.

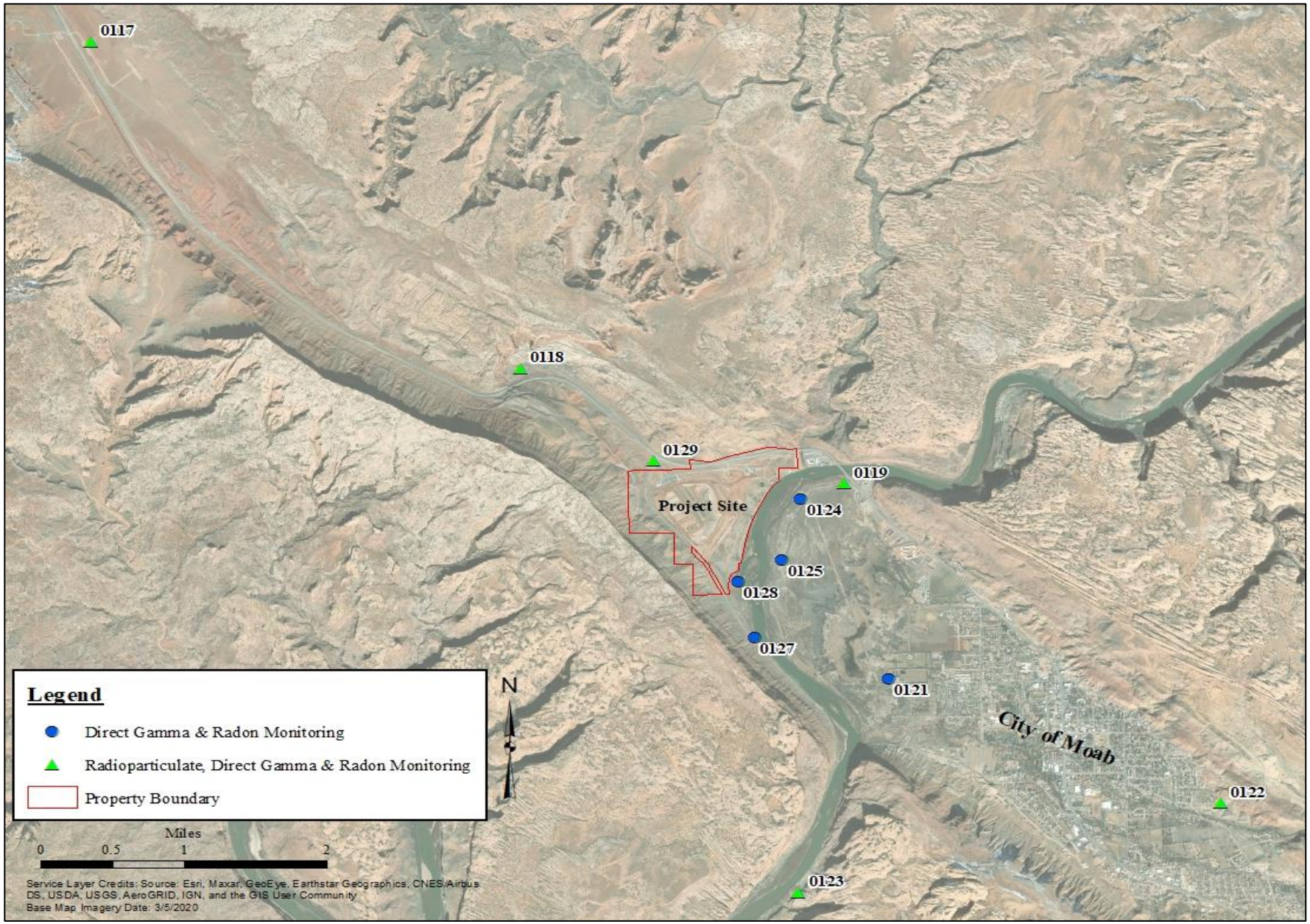

Figure 1. Moab Off-site Environmental Air Monitoring Locations

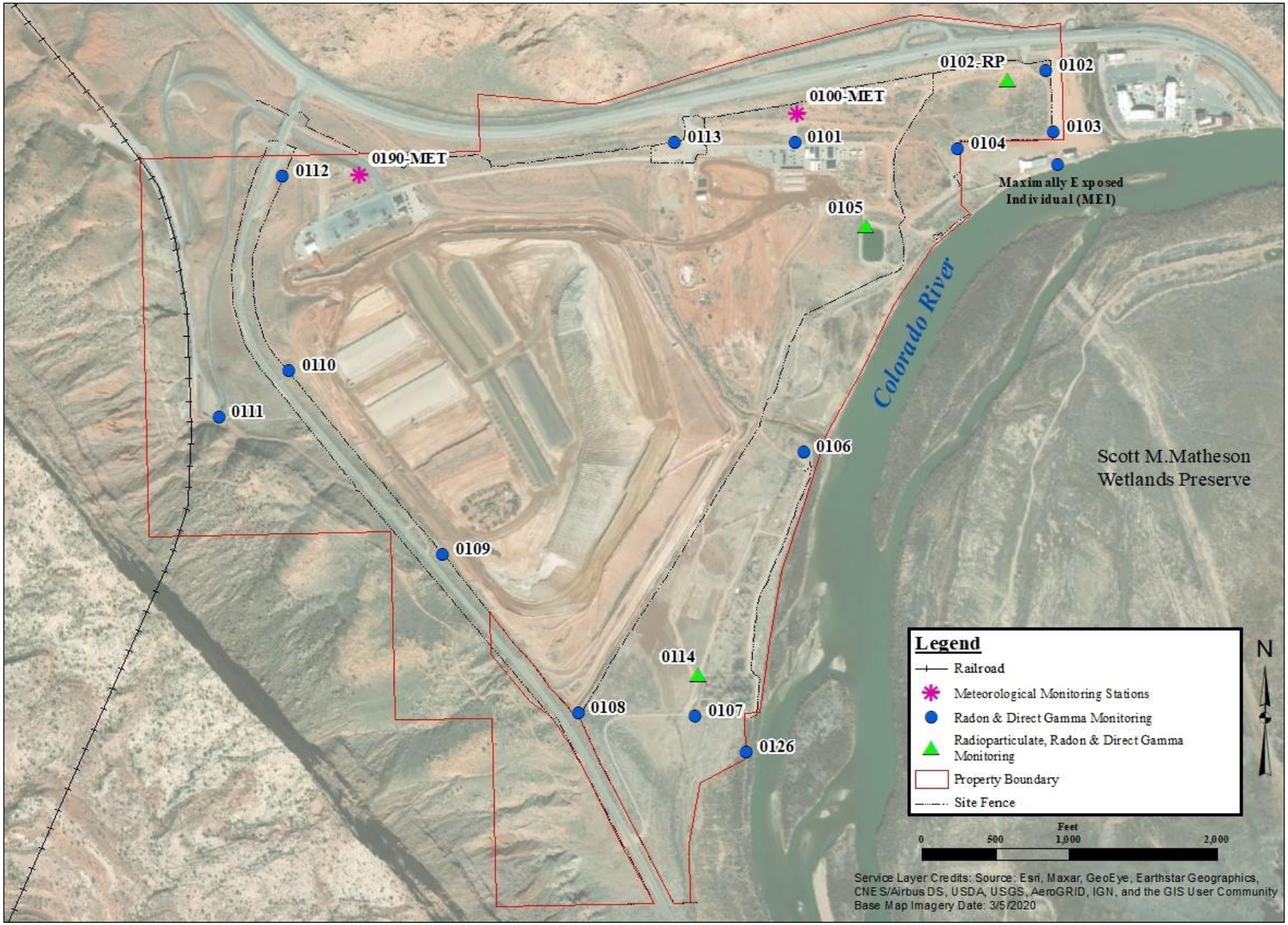

Figure 2. Moab On-site and Maximally Exposed Individual Environmental Air Monitoring Locations

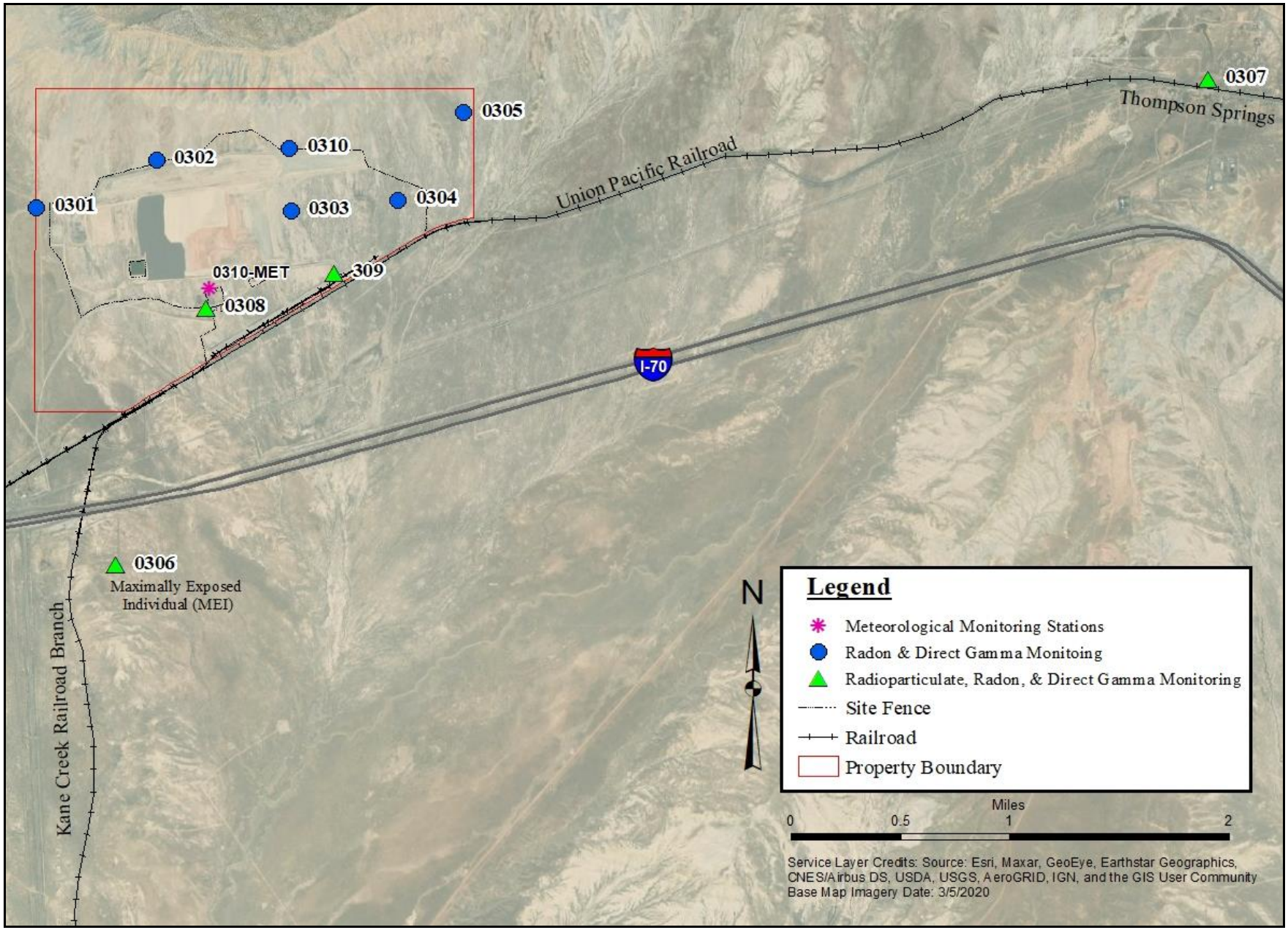

Figure 3. Crescent Junction Site Environmental Air Monitoring Locations

3.1.1 Meteorological Analysis

Meteorological data were collected from the on-site meteorological station (northwest portion of the site) and downloaded from the Vista Data Vision online database, where meteorological data are uploaded from the site. Hourly averages were analyzed. Figure 4 displays the wind rose for this quarter, with the wedges on the wind rose showing which direction the wind is coming from. In third quarter 2020, the winds were primarily out of the north/northwest and southeast. The average temperature for the quarter was 81°F. The lowest recorded temperature for the quarter was 44°F, and the highest was 107°F.

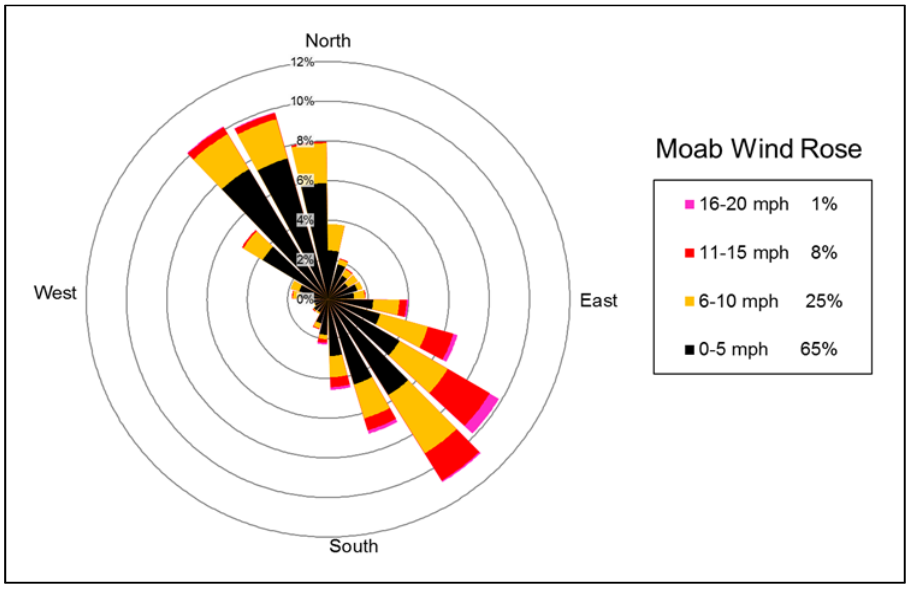

Figure 4. Moab Wind Rose for Third Quarter 2020

The site received 0.43 inches of precipitation during the third quarter 2020. Figure 5 presents the Moab average (which is from 2010 through 2019), 2019, and 2020 cumulative precipitation. As this graph displays, the third quarter 2020 precipitation is below the site's nine-year average.

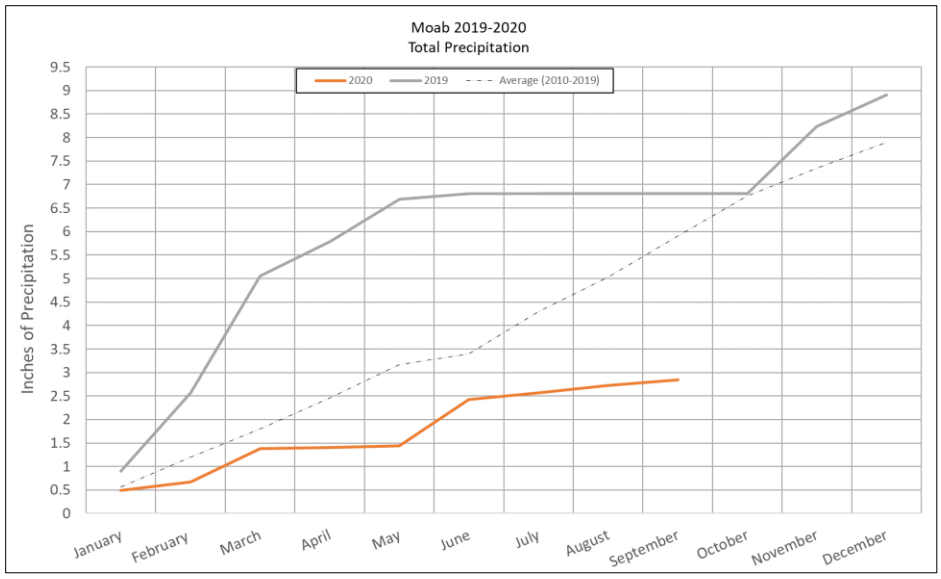

Figure 5. Moab Average, 2019, and Third Quarter 2020 Cumulative Precipitation

3.1.2 Radon

Based on five years of data between 2003 and 2008 from stations 0117 and 0123, the average background concentration of radon in the Moab area was established as 0.7 pCi/L. Therefore, the Project's annual average radon emission limit at the Moab site boundary is 3.7 pCi/L. On-site monitoring locations close to the site boundary or publicly accessible areas are used to demonstrate compliance at the boundary. Table 1 shows quarterly and annual radon results for the past year (including background) for on- and off-site locations.

Table 1. Radon Concentrations for the Moab Site for the Past Year

Station Number	Fourth Quarter 2019 (pCi/L)	First Quarter 2020 (pCi/L)	Second Quarter 2020 (pCi/L)	Third Quarter 2020 (pCi/L)	Annual Average Concentration Based on Four Quarters (pCi/L)
On-site Locations					
0101	7.0	1.9	1.4	2.8	**3.3**
0102	3.9	1.0	0.8	1.5	**1.8**
0103	4.5	1.2	0.8	1.4	**2.0**
0104	5.4	1.7	1.1	2.3	**2.6**
0105	6.5	1.7	1.4	2.5	**3.0**
0106	7.6	3.2	1.8	3.1	**3.9**
0107	6.6	2.5	1.5	2.6	**3.3**
0108	7.4	2.3	1.9	3.6	**3.8**
0109	2.8	1.0	1.2	1.9	**1.7**
0110	2.6	1.0	1.2	2.1	**1.7**
0111	1.5	0.4	0.5	0.9	**0.8**
0112	3.1	1.0	1.3	2.5	**2.0**
0113	6.6	1.6	1.4	3.3	**3.2**
0114	6.4	3.3	1.9	2.9	**3.6**
0126	5.2	2.1	1.3	2.1	**2.7**
Off-site Locations					
0117	1.0	0.3	0.2	0.4	**0.5**
0118	1.0	0.4	0.3	0.8	**0.6**
0119	1.8	0.6	0.4	0.9	**0.9**
0121	0.6	0.3	0.2	0.7	**0.4**
0122	< 0.5	0.2	<0.1	0.4	**0.3**
0123	0.5	0.2	0.2	0.4	**0.3**
0124	2.3	0.8	NS	1.1	**NA**
0125	2.3	1.0	0.7	1.2	**1.3**
0127	1.7	0.5	0.4	0.9	**0.9**
0128	4.5	1.7	1.3	1.9	**2.4**
0129	3.2	1.0	1.1	2.1	**1.9**
MEI	3.7	1.1	0.6	1.4	**1.7**

Background has not been subtracted from annual values

NS = No Sample collected from this location, detector missing upon collection (unknown cause)

NA = Not Applicable, insufficient data to calculate a representative annual average

The Moab locations with the highest annual average radon concentrations as of the third quarter of 2020 are displayed in Figure 6. Locations 0101, 0106, 0107, 0108, 0113, and 0114 continue to have the highest annual average from the last quarter. Two on-site stations exceeded the 3.7 pCi/L annual average limit.

However, these stations are located on-site, and no member of the public has access to or occupies any of those locations to receive a dose in excess of the annual limit. When compared to the previous quarter, the data indicate third quarter 2020 concentrations at all of the on-site locations increased as much as 1.9 pCi/L, and as much as 1.0 pCi/L at all off-site locations.

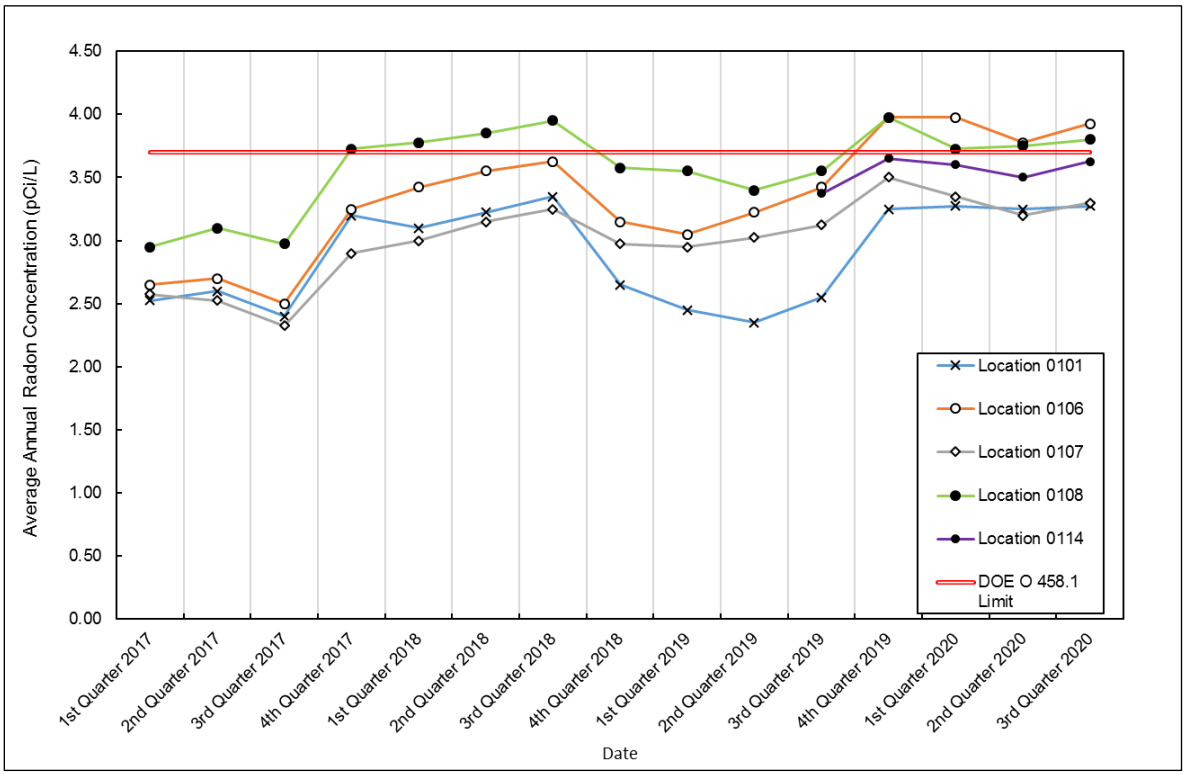

Figure 6. Moab Locations with Highest Third Quarter 2020 Average Annual Radon Concentrations

3.1.3 Direct Gamma Radiation

The average annual background (based on five years of data between 2003 and 2008) direct gamma radiation effective dose for the Moab area was established as 82 mrem/year. Table 2 shows quarterly and annual gamma results for the past year, including background, at on- and off-site locations. These readings represent the gamma dose an individual would receive from occupying a location for an entire year.

Compared to the previous quarter, this quarter's analytical results indicate the dose increased at seven of the on-site locations by as much as 12 mrem, while five on-site locations decreased by as much as 3 mrem. The off-site results indicate two stations increased by as much as 3 mrem while eight locations decreased by as much as 5 mrem. One off-site location results indicated no change from the previous quarter.

Table 2. Gamma Radiation Effective Doses for the Moab Site for the Past Year

Station Number	Fourth Quarter 2019 (mrem)	First Quarter 2020 (mrem)	Second Quarter 2020 (mrem)	Third Quarter 2020 (mrem)	Annual Dose Based on Four Quarters (mrem)
On-site Locations					
0101	43	43	45	43	**174**
0102	28	28	25	26	**107**
0103	28	28	25	25	**106**
0104	31	31	29	27	**118**
0105	28	29	27	28	**112**
0106	39	37	34	37	**147**
0107	32	35	31	30	**128**
0108	47	43	46	46	**182**
0109	118	111	112	119	**460**
0110	107	102	96	108	**413**
0111	41	41	38	39	**159**
0112	NS	49	52	53	**ND**
0113	45	41	46	43	**175**
0114	37	36	34	34	**141**
0126	33	33	29	28	**123**
Off-site Locations					
0117	29	30	27	26	**112**
0118	24	26	25	24	**99**
0119	28	28	26	25	**107**
0121	25	26	27	22	**100**
0122	24	25	23	20	**92**
0123	27	24	23	20	**94**
0124	29	30	NS	27	**NA**
0125	31	31	30	29	**121**
0127	29	29	28	27	**113**
0128	30	29	27	28	**114**
0129	35	34	33	33	**135**
MEI	28	28	24	27	**107**

Background has not been subtracted from annual values

NS = No Sample collected from this location, TLD missing upon collection (unknown cause)

NA = Not Applicable, insufficient data to calculate a representative annual dose

3.1.4 Radioparticulates

The effective background dose from inhalation of radioparticulates was not determined, so all effective dose from radioparticulates measured at the Project's monitoring stations are assumed to be from the Project. Table 3 provides the calculated quarterly and annual effective dose from inhalation of radioparticulates for the past year for the Moab site. Filters were analyzed for concentrations of total Uranium, Actinium-227, Thorium-230, Radium-226, and Polonium-210. Since Actinium-227 and Protactinium-231 are assumed to be in equilibrium, the concentration of Protactinium-231 is estimated by dividing the analyzed Actinium-227 concentration by a correction factor of 0.614, which is consistent with the Moab UMTRA Project Health Physics Plan (DOE-EM/GJ3003).

Table 3. Radioparticulate Effective Doses for the Moab Site for the Past Year

Station Number	Isotope	Fourth Quarter 2019 (mrem)	First Quarter 2020 (mrem)	Second Quarter 2020 (mrem)	Third Quarter 2020 (mrem)	Annual Total Dose Based on Four Quarters (mrem)
On-site Locations						
0102-RP (MEI)	Total Uranium	0.004	0.002	0.003	0.003	**3.55**
	Thorium-230	0.091	0.008	0.032	0.045	
	Radium-226	0.110	0.022	0.034	0.057	
	Polonium-210	0.708	0.529	0.301	0.383	
	Actinium-227	0.303	0.105	0.280	0.303	
	Protactinium-231	0.070	0.024	0.064	0.070	
105-RP	Total Uranium	0.007	0.003	0.004	0.005	**5.14**
	Thorium-230	0.266	0.027	0.104	0.141	
	Radium-226	0.282	0.033	0.070	0.114	
	Polonium-210	0.977	0.708	0.350	0.627	
	Actinium-227	0.443	0.124	0.096	0.490	
	Protactinium-231	0.102	0.028	0.022	0.113	
0114-RP	Total Uranium	0.008	0.003	0.005	0.006	**7.19**
	Thorium-230	0.261	0.067	0.157	0.208	
	Radium-226	0.290	0.088	0.037	0.154	
	Polonium-210	0.895	0.635	0.358	0.635	
	Actinium-227	0.490	ND	1.632	0.629	
	Protactinium-231	0.113	ND	0.375	0.145	
Off-site Locations						
0117-RP	Total Uranium	0.003	0.002	0.003	0.003	**2.18**
	Thorium-230	0.017	0.014	0.017	0.017	
	Radium-226	0.008	0.021	0.011	0.007	
	Polonium-210	0.472	0.545	0.252	0.358	
	Actinium-227	ND	0.089	0.256	ND	
	Protactinium-231	ND	0.020	0.059	ND	
0118-RP	Total Uranium	0.003	0.004	0.004	0.002	**2.46**
	Thorium-230	0.069	0.021	0.064	0.067	
	Radium-226	0.041	0.029	0.066	0.037	
	Polonium-210	0.545	0.440	0.277	0.326	
	Actinium-227	ND	0.023	0.233	0.126	
	Protactinium-231	ND	0.005	0.054	0.029	
0119-RP	Total Uranium	0.003	0.002	0.003	0.003	**2.47**
	Thorium-230	0.056	0.014	0.026	0.032	
	Radium-226	0.034	ND	0.009	0.019	
	Polonium-210	0.545	0.513	0.244	0.350	
	Actinium-227	ND	0.023	0.154	0.326	
	Protactinium-231	ND	0.005	0.035	0.075	
0122-RP	Total Uranium	0.003	0.003	0.003	0.003	**2.51**
	Thorium-230	0.027	0.020	0.029	0.020	
	Radium-226	0.029	0.018	0.038	0.023	
	Polonium-210	0.464	0.578	0.277	0.423	
	Actinium-227	0.075	ND	0.303	0.072	
	Protactinium-231	0.017	ND	0.070	0.017	

Table 3. Radioparticulate Effective Doses for the Moab Site for the Past Year (continued)

Station Number	Isotope	Fourth Quarter 2019 (mrem)	First Quarter 2020 (mrem)	Second Quarter 2020 (mrem)	Third Quarter 2020 (mrem)	Annual Total Dose Based on Four Quarters (mrem)
Off-site Locations (*continued*)						
0123-RP	Total Uranium	0.003	0.002	0.003	0.002	**2.78**
	Thorium-230	0.025	0.004	0.029	0.023	
	Radium-226	0.024	0.022	0.018	0.019	
	Polonium-210	0.480	0.545	0.391	0.342	
	Actinium-227	0.172	0.028	0.212	0.280	
	Protactinium-231	0.040	0.006	0.049	0.064	
0129-RP	Total Uranium	0.006	0.003	0.006	0.004	**7.99**
	Thorium-230	0.373	0.048	0.266	0.293	
	Radium-226	0.308	0.053	0.207	0.136	
	Polonium-210	0.692	0.529	0.317	0.358	
	Actinium-227	1.235	0.280	1.072	0.979	
	Protactinium-231	0.284	0.064	0.247	0.225	

ND = not detected; analyte concentration below detection limit

These analytical results are used to calculate the effective dose from the inhalation of radioparticulates. The annual dose associated with the stations closest to the site operations (0102, 0105, 0114, and 0129) is higher compared to the remaining stations. Four stations saw an increase in annual dose (up to 0.843 mrem) compared to the previous quarter's annual dose, while five stations showed a decrease in dose, as much as 0.788 mrem.

3.1.5 Total Effective Dose

The Project must ensure the annual total effective dose to gamma radiation and radioparticulates from Project activities does not exceed 100 mrem above background. The MEI annual total effective dose for this quarter was 28.55 mrem, which is well below the DOE limit. This value was calculated by subtracting the background dose of 82 mrem from the MEI annual gamma radiation dose of 107 mrem and then adding the radioparticulate total dose of 3.55 mrem from location 0102, the closest radioparticulate station to the MEI. Nearly all of the dose to the MEI is due to direct gamma radiation. The dose to the lens of the eye, skin, and extremities is the same as a full body dose and is below the regulatory limit of 1500 mrem in a year to the lens of the eye and 5000 mrem in a year to the skin or extremities. Figure 7 shows total effective dose measured at the Moab site since 2018.

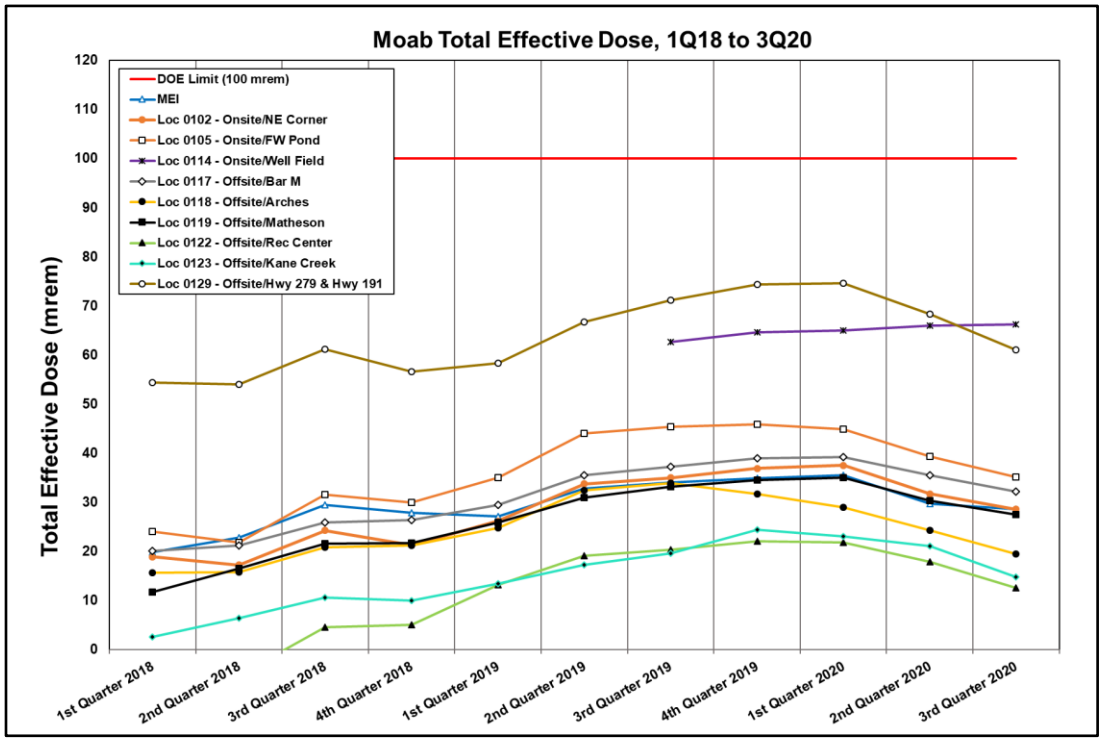

Figure 7. Total Effective Dose Measured at Moab Locations Since 2018

3.2 Crescent Junction Site

There are nine air monitoring stations associated with the Crescent Junction site, two located off site and seven on-site. All nine are equipped with radon and gamma detectors. Two on-site and two off-site stations are equipped with air sampling pumps to measure air radioparticulates. After mill tailings disposal began in the second quarter of 2009, the Crescent Junction monitoring location 0306 became the MEI. Due to disposal cell excavation activities, station 0303 was removed. One radon and direct gamma station was added to the northern site boundary fence and labeled as 0310.

3.2.1 Meteorological Analysis

Meteorological data were collected from the on-site meteorological station and downloaded from the Vista Data Vision online database, where meteorological data are uploaded from the site. Hourly averages were analyzed.

Figure 4 displays the wind rose for this quarter, with the wedges on the wind rose showing which direction the wind is coming from. In third quarter 2020, the winds were variable with the prevailing wind out of the west/southwest. The site received 0.21 inches of precipitation during the third quarter 2020. Figure 5 presents the Crescent Junction average (which is from 2010 through 2019), 2019, and 2020 cumulative precipitation. As this graph displays, the third quarter 2020 precipitation is below the site's nine-year average. The average temperature for the quarter was 79°F. The lowest recorded temperature for the quarter was 41°F, and the highest was 102°F.

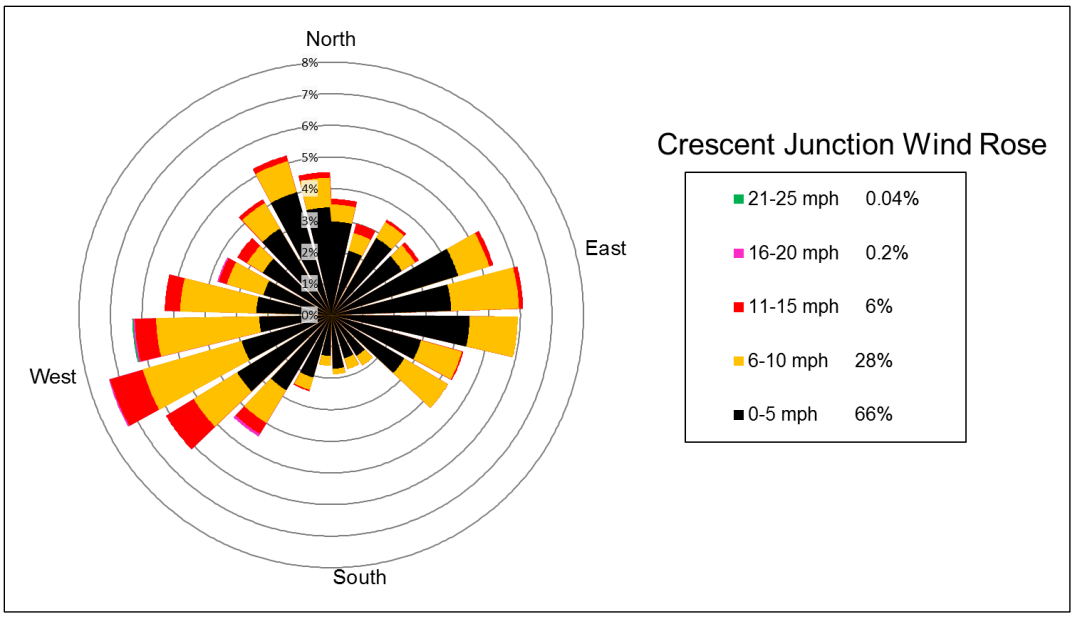

Figure 8. Crescent Junction Wind Rose for Third Quarter 2020

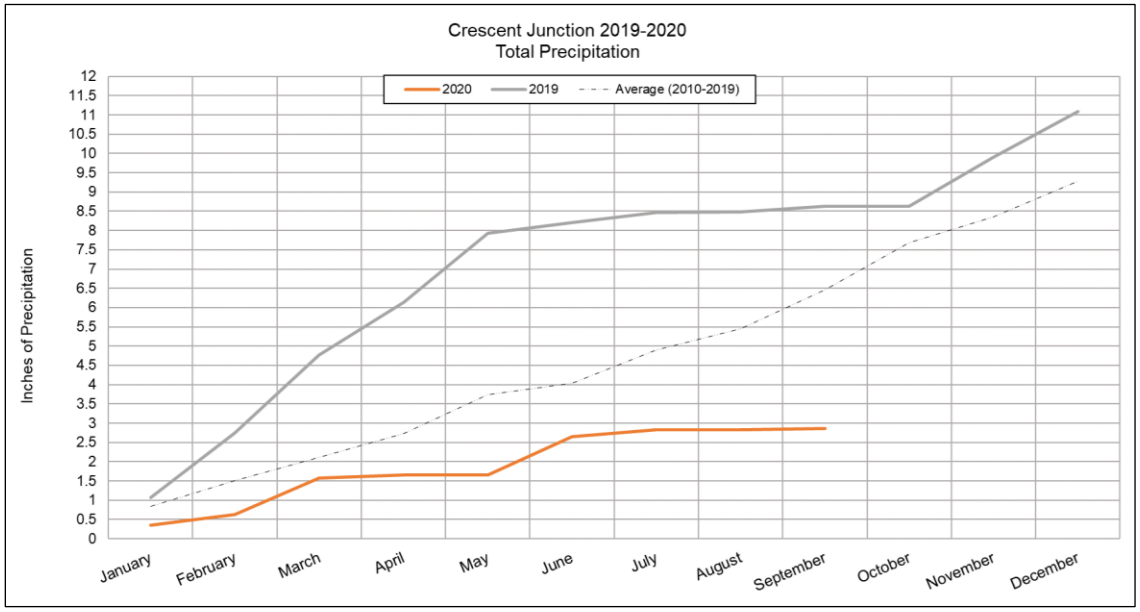

Figure 9. Crescent Junction Average, 2019, and Third Quarter 2020 Cumulative Precipitation

3.2.2 Radon

Based on three years of data from 2006 to 2009, the background concentration of radon in the Crescent Junction area was established as 0.9 pCi/L. Therefore, the Project must limit radon emissions at the Crescent Junction site boundary (withdrawal area) to 3.9 pCi/L. None of the on- or off-site stations exceeded the limit of 3.9 pCi/L in the third quarter 2020. Locations 0301 and 0305 are used to demonstrate compliance with the public dose limit in DOE O 458.1 at the site boundary. Table 4 shows quarterly and annual radon results for the past year, including background for on- and off-site locations.

Table 4. Radon Concentrations for the Crescent Junction Site for the Past Year

Station Number	Fourth Quarter 2019 (pCi/L)	First Quarter 2020 (pCi/L)	Second Quarter 2020 (pCi/L)	Third Quarter 2020 (pCi/L)	Annual Average Concentration Based on Four Quarters (pCi/L)
On-site Locations					
0301	1.0	0.4	0.3	0.5	**0.6**
0302	1.1	0.6*	0.4	0.7	**0.7**
0303	2.0	1.1*	0.8	NS	**NA**
0304	1.4	0.4	0.4	0.8	**0.8**
0305	1.0	0.4	0.3	0.6	**0.6**
0308	4.0	1.5	1.2	2.2	**2.2**
0309	2.0	0.8	1.0	1.4	**1.3**
0310	NS	NS	NS	0.7	**NA**
Off-site Locations					
0306 (MEI)	1.1	0.4	0.2	0.6	**0.6**
0307	0.8	0.3	0.2	0.4	**0.4**

Background has not been subtracted from annual values.
* = RadTrack^2 detector

NS = No Sample collected from this location

NA = Not Applicable, insufficient data to calculate a representative annual average

Compared to the previous quarter, the radon concentrations at all on-site stations increased as much as 1.0 pCi/L. Both off-site stations showed an increase from the previous quarter as much as 0.4 pCi/L. The five Crescent Junction locations with the highest annual average radon concentrations during the second quarter are shown on Figure 10, which displays the annual average concentrations for these locations since the first quarter of 2017.

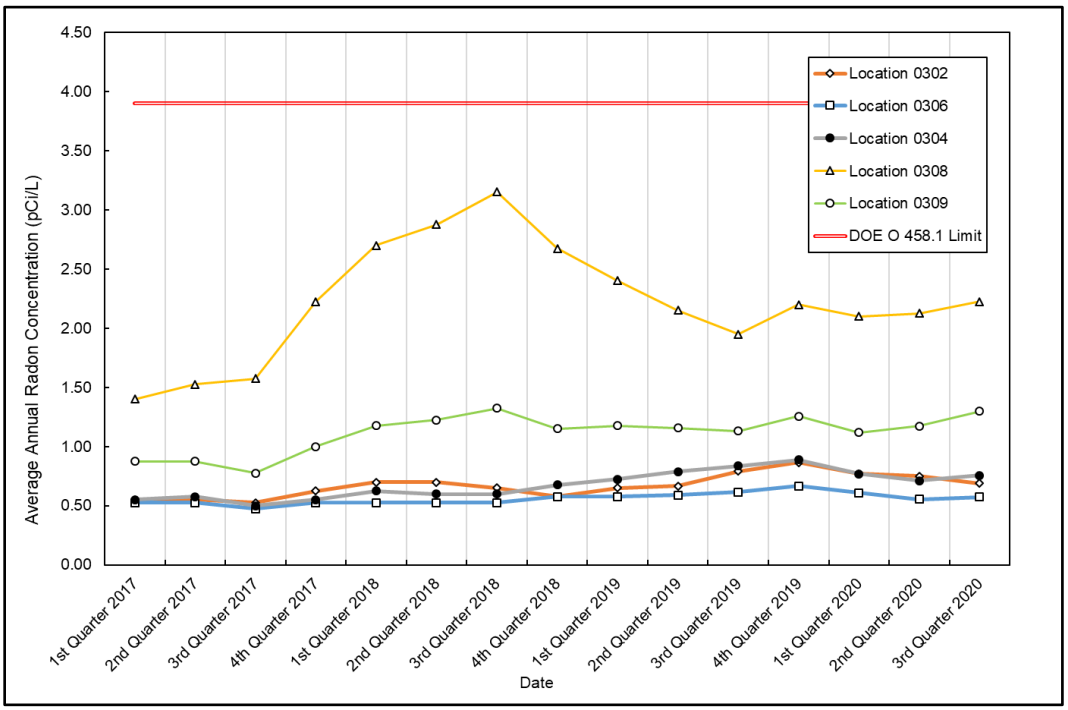

Figure 10. Crescent Junction Locations with Highest Third Quarter 2020 Average Annual Radon Concentrations

3.2.3 Direct Gamma Radiation

The average annual background direct gamma radiation exposure dose for the Crescent Junction area was established as 92.5 mrem based on three years of data from 2006 to 2009. Table 5 shows quarterly and annual results for the past year, including background for on- and off-site locations. These results represent the gamma dose an individual would receive from occupying a location for an entire year.

This quarter's analytical results compared to the previous quarter's indicated that the gamma radiation dose decreased at all of the Crescent Junction stations as much as 4.0 mrem, except one, which indicated no change. Both off-site stations showed a decrease in gamma radiation by as much as 3 mrem.

Table 5. Gamma Radiation Effective Doses for the Crescent Junction Site for the Past Year

Station Number	Fourth Quarter 2019 (mrem)	First Quarter 2020 (mrem)	Second Quarter 2020 (mrem)	Third Quarter 2020 (mrem)	Annual Total Dose Based on Four Quarters (mrem)
On-site Locations					
0301	25	27	28	27	**107**
0302	30	28	29	26	**113**
0303	44	44	54	NS	**NA**
0304	29	29	29	27	**114**
0305	30	31	30	26	**117**
0308	32	32	29	29	**122**
0309	29	28	29	28	**114**
0310	NS	NS	NS	27	**NA**
Off-site Locations					
0306 (MEI)	26	28	27	26	**107**
0307	28	32	30	27	**117**

Background has not been subtracted from annual values

NS = No Sample collected from this location

NA = Not Applicable, insufficient data to calculate a representative annual average

3.2.4 Radioparticulates

The effective background dose from inhalation of radioparticulates at the Crescent Junction site was not determined. Therefore, all effective dose measured at the Project's monitoring stations is assumed to be from the Project. Samples were collected at the four monitoring locations at or near the Crescent Junction site to determine the air particulate concentrations of total Uranium, Thorium-230, Radium-226, Polonium-210, Actinium-227, and Protactinium-231 (based on the Actinium-227 concentration, as described in Section 3.1.4). All Crescent Junction stations saw an increase in annual dose, by as much as 0.5 mrem. Table 6 shows radioparticulate effective doses for the Crescent Junction site for the past year.

Table 6. Radioparticulate Effective Doses for the Crescent Junction Site for the Past Year

Station Number	Isotope	Fourth Quarter 2019 (mrem)	First Quarter 2020 (mrem)	Second Quarter 2020 (mrem)	Third Quarter 2020 (mrem)	Annual Total Dose Based on Four Quarters (mrem)
On-site Locations						
0308-RP	Total Uranium	0.003	0.002	0.003	0.003	**4.07**
	Thorium-230	0.080	0.027	0.037	0.120	
	Radium-226	0.084	0.041	0.048	0.097	
	Polonium-210	0.537	0.529	0.309	0.366	
	Actinium-227	0.466	0.124	0.303	0.559	
	Protactinium-231	0.107	0.028	0.070	0.129	
0309-RP	Total Uranium	0.004	0.003	0.003	0.005	**4.60**
	Thorium-230	0.136	0.048	0.109	0.115	
	Radium-226	0.167	0.057	0.150	0.128	
	Polonium-210	0.497	0.456	0.293	0.456	
	Actinium-227	0.490	0.280	0.443	0.396	
	Protactinium-231	0.113	0.064	0.102	0.091	
Off-site Locations						
306-RP MEI	Total Uranium	0.002	0.002	0.002	0.002	**2.60**
	Thorium-230	0.016	0.008	0.016	0.015	
	Radium-226	0.025	0.012	0.015	0.037	
	Polonium-210	0.488	0.448	0.244	0.358	
	Actinium-227	0.280	0.047	0.133	0.280	
	Protactinium-231	0.064	0.011	0.031	0.064	
0307-RP	Total Uranium	0.003	0.002	0.003	0.002	**2.41**
	Thorium-230	0.019	0.012	0.019	0.013	
	Radium-226	0.009	0.020	0.013	0.019	
	Polonium-210	0.423	0.464	0.277	0.334	
	Actinium-227	0.105	ND	0.179	0.350	
	Protactinium-231	0.024	ND	0.041	0.080	

ND = not detected; analyte concentration below detection limit

3.2.5 Total Effective Dose

The annual total effective dose to the Crescent Junction MEI was 17.1 mrem, which is well below the annual limit of 100 mrem. This is calculated by subtracting the background dose of 92.5 mrem from the MEI (location 0306) gamma radiation dose of 107 mrem, and then adding the radioparticulate dose of 2.60 mrem for the MEI, which decreased 6.16 mrem compared to the previous quarter. Figure 11 is a plot of the total effective dose from the four Crescent Junction locations since 2018. In Figure 11, the background was subtracted from the total effective dose calculations, therefore, the DOE limit is shown as 100 mrem. The total effective dose decreased by as much as 5.2 mrem since the last quarter at all locations. Nearly all of the dose to the MEI is due to direct gamma radiation. The dose to the lens of the eye, skin, and extremities is the same as a full body dose and is below the regulatory limit of 1500 mrem in a year to the lens of the eye and 5000 mrem in a year to the skin or extremities.

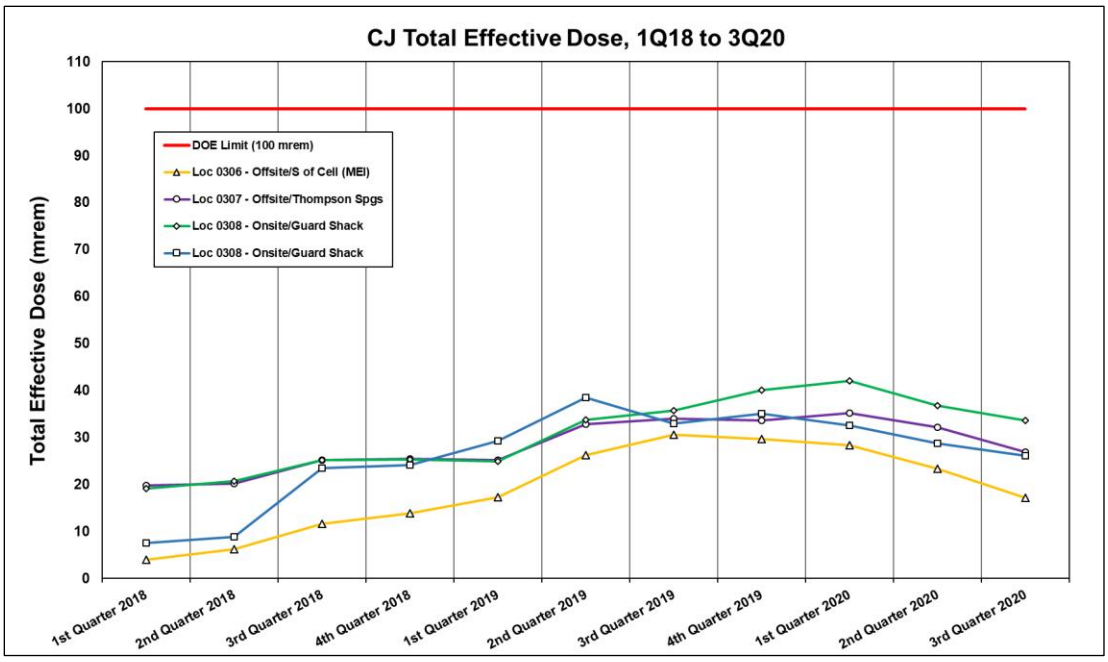

Figure 11. Total Effective Dose Measured at Crescent Junction Locations Since 2018

4.0 Data Assessment

Radon detectors, thermoluminescent dosimeters used for continuous dose measurements, and radioparticulate sample filters were sent to qualified off-site laboratories for analyses in accordance with the *Moab UMTRA Project Environmental Air Monitoring Sampling and Analysis Plan* (SAP) (DOE-EM/GJTAC2219). Qualified Project personnel evaluated the analytical data received for consistency with other data points and Quality Assurance/Quality Control samples.

Due to order discrepancies in first quarter 2020, four stations in Crescent Junction were equipped with the previous Radtrack^2 radon detectors. To account for the Radtrack^2 lower detection limit, those monitors were placed at locations that historically had elevated radon concentrations. The stations have been identified in the tables accordingly.

4.1 Quality Assurance/Quality Control Sampling

Duplicate samples for radon were collected at Moab locations 0102, 0108, and 0111, and at Crescent Junction locations 0303 and 0308. In addition, duplicate direct gamma samples were collected at Moab locations 0102, 0108, and 0129 and Crescent Junction locations 0301 and 0305. All results associated with the duplicate sampling are provided in Table 7. No duplicate samples were collected for radioparticulate samples, per the SAP.

As Table 7 displays, the five locations that included duplicate radon samples were within 0.4 pCi/L of each other. The five locations equipped with duplicate gamma detectors were all within 2.0 mrem of each other. These radon and gamma duplicate results are within the acceptable ranges, and the data are considered valid based on these results.

Table 7. Duplicate Results for Third Quarter 2020

Location	Result	Duplicate Result
Moab		
Radon:	pCi/L	pCi/L
0102	1.5	1.1
0108	3.6	3.6
0111	0.86	0.92
Gamma:	mrem	mrem
0102	26	25
0108	46	47
0129	33	33
Crescent Junction		
Radon:	pCi/L	pCi/L
0310	0.65	0.65
0308	2.2	2.2
Gamma:	mrem	mrem
0301	27	25
0305	26	28

Control samples measured the dose for gamma and radon while being shipped from the site to the respective analytical laboratories. Transit values for direct gamma were not subtracted from this quarter's data. The Radonova lab subtracts the average transit exposure from the reported radon concentrations. The transit values are shown in Table 8.

Table 8. Shipment Control Sample Results for Third Quarter 2020

Sample	Result
Gamma:	mrem
In-transit 1	21
In-transit 2	20
Radon:	pCi/L
In-transit 1	7 +/- 9
In-transit 2	12 +/- 9

4.2 Suspected Anomalies

All analytical data are reviewed for anomalous or outlying data points. Monitoring data are evaluated against historical and minimum/maximum values to determine if the reported data are within reasonable expected ranges. No anomalous data were noted for the third quarter of 2020.

4.3 Summary

Data collected during the third quarter of 2020 met the applicable laboratory control criteria for their respective analyses. The results were within the acceptable limits associated with each matrix. Data in this report are considered validated and may be treated as final results.

5.0 References

DOE (U.S. Department of Energy), *Moab UMTRA Project Environmental Air Monitoring Sampling and Analysis Plan* (DOE-EM/GJTAC2219).

DOE (U.S. Department of Energy), *Moab UMTRA Project Fourth Quarter 2019 Environmental Air Monitoring Report* (DOE-EM/GJ3028).

DOE (U.S. Department of Energy), *Moab UMTRA Project Health Physics Plan* (DOE-EM/GJ3003).

DOE (U.S. Department of Energy) Order 458.1, Admin Chg 1, "Radiation Protection of the Public and the Environment.